U.S.S.N. 09/822,749

REMARKS

Thorough examination and careful review of the application by the Examiner is noted and appreciated.

Claims 1-10 are pending in the application. Claims 1-10 stand rejected.

Claim Rejections Under 35 USC §103

Claims 1-10 are rejected under 35 USC §103(a) as being unpatentable over the admitted prior art in view of Moffat '393 and further in view of Collins '414. It is contended that while the admitted prior art fails to expressly disclose performing all three processes in the same plasma chamber, Moffat discloses performing both baking and descumming resist processes in the same plasma etching chamber. Furthermore, while Moffat fails to show the plasma chamber including a wafer heating and cooling device that heats and cools the wafer via the flowing of inert gas on the backside of the wafer, Collins discloses controlling the substrate temperature using a controller where inert helium gas is used at the backside of the wafer.

The rejection of claims 1-10 under 35 USC §103(a) based on the admitted prior art, Moffat and Collins is respectfully traversed.

While the Applicants agree with the Examiner that the admitted prior art fails to disclose performing all three processes in the same process chamber, the Applicants respectfully submit such is further not taught or disclosed by Moffat and Collins, combined.

Moffat '393 discloses a wafer processing apparatus which includes a plasma etching unit, a wet processing spin-spray unit, a robotic wafer transfer arm, and a central control computer all contained in the same housing (see Abstract). The apparatus is designed to perform manufacturing tasks especially related to photoresist processing, photoresist developing, descumming, baking and hardening, and stripping. As shown by Moffat in Fig. 16, and at col. 6, lines 56-58:

> "This processing routine first develops exposed photoresist, then **hardens the resist with heat**, and **removes resist 'scum'**."

Furthermore, at col. 7, lines 3-6, Moffat discloses:

> "With the plasma chamber door closed 139, the unit pulls a vacuum below 1 Torr 140 and **starts the heating lamps**. The heating lamps are run through a predetermined temperature cycle to **hard bake** the photoresist 141."

The present invention, on the other hand, recites a method for in-situ descum/hard bake/dry etch a polyimide photoresist layer in a single process chamber. As clearly recited in independent claim 1:

> "Claim 1. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber comprising the steps of:
>
> providing a process chamber ...;
>
> positioning a wafer having a passivation layer ...;
>
> **generating an O_2 plasma** in said chamber **conducting a descum process;**
>
> **flowing a heated inert gas** onto a backside of said wafer **conducting a hot bake process;** and

flowing a cooling inert gas onto said wafer backside and **an etchant** into said chamber **conducting a dry etch process** for a via opening on said wafer."

The Applicants respectfully submit that Moffat teaches a process that is patentably distinct from the present invention process in three major elements:

1. Moffat teaches a process of hard bake first and then descum (see Fig. 16), while the present invention teaches a process of descumming first and then hard bake.
2. Moffat teaches a hard bake process by irradiating a wafer with heating, while the present invention teaches and claims a process of hard bake by **flowing a heated inert gas onto a backside of the wafer.**

The Moffat process, as defined in Fig. 16, only contains the two steps of hard bake and descum, while the present invention process, as recited in independent claim 1, is a three step process of descum, hard bake and dry etch.

The Applicants further submit that none of the three major distinctions between the Moffat reference and the present invention method is taught or disclosed by Collins '414 for conducting in the same process chamber and in the same process.

In the Response to Arguments section of the 04/04/2003 Office Action, the Examiner further noted that "the Examiner respectfully points out that Moffat is not being relied upon to show the hard bake by **flowing a heated inner gas onto a backside of the wafer**, instead, Collins is relied upon to show this limitation". The Applicants respectfully disagree with the Examiner that Collins contains such showing. For instance, at col. 23, lines 23-27:

> "For example, a recircuating closed lop heat exchanger 90 can be used **to flow fluid**, preferably dielectric fluid, **through the block and pedestal of the substrate support/cathode** 32C, as indicated schematically by flow path 91, to cool (and/or heat) the substrate support."

The Applicants respectfully submit that in the cooling method or step disclosed by Collins, the wafer support block or pedestal is cooled, not the wafer backside. The present invention claim 1, which specifically recites the step of "flowing a cooling inert gas onto said wafer backside" is not taught or disclosed by Collins, Moffat and the admitted prior art. The combined teachings of the three references does not teach such process step.

The rejection of claims 1-10 under 35 USC §103(a) based on the admitted prior art, Moffat and Collins is respectfully traversed. A reconsideration for allowance of these claims is respectfully requested of the Examiner.

Based on the foregoing, the Applicants respectfully submit that all of the pending claims, i.e. claims 1-10, are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

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In the event that the present invention is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

Tung & Associates

Randy W. Tung
Reg. No. 31,311
Telephone: (248) 540-4040

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